

## N-channel 250V 140mΩ Power MOSFET

### Description

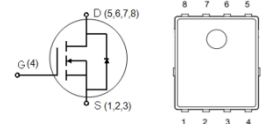
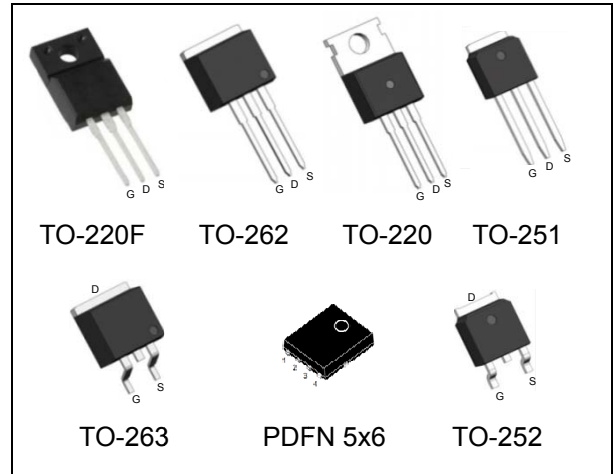
WMOS<sup>TM</sup> JN is suitable for applications which require superior power density and outstanding efficiency.

### Features

- Gate charge minimized
- Typ.  $R_{DS(on)} = 140\text{ m}\Omega$
- 100% UIS tested
- Pb-free plating, Halogen free

### Applications

Switching applications



PDFN 5x6

### Absolute Maximum Ratings

| Parameter   | Symbol         | WMx17N25JN  | WML17N25JN | Unit                |
|---|----------------|-------------|------------|---------------------|
| Drain-source voltage  | $V_{DSS}$      | 250         |            | V                   |
| Continuous drain current <sup>1)</sup> ( $T_C = 25^\circ\text{C}$ )                 | $I_D$          | 11          |            | A                   |
|   |                | 6.5         |            | A                   |
| Pulsed drain current <sup>2)</sup>  | $I_{DM}$       | 33          |            | A                   |
| Gate-source voltage   | $V_{GS}$       | $\pm 20$    |            | V                   |
| Avalanche energy, single pulse <sup>3)</sup>  | $E_{AS}$       | 80          |            | mJ                  |
| Avalanche energy, repetitive <sup>2)</sup>  | $E_{AR}$       | 0.15        |            | mJ                  |
| Avalanche current, repetitive <sup>2)</sup>   | $I_{AR}$       | 1.2         |            | A                   |
| Power dissipation ( $T_C = 25^\circ\text{C}$ )<br>- Derate above $25^\circ\text{C}$ | $P_D$          | 36          | 20         | W                   |
|   |                | 0.29        | 0.16       | W/ $^\circ\text{C}$ |
| Operating and storage temperature range   | $T_j, T_{stg}$ | -55 to +150 |            | $^\circ\text{C}$    |
| Continuous diode forward current  | $I_S$          | 11          |            | A                   |
| Diode pulse current   | $I_{S,pulse}$  | 33          |            | A                   |

### Thermal Characteristics

| Parameter                               | Symbol          | WMx17N25JN | WML17N25JN | Unit                      |
|---|-----------------|------------|------------|---------------------------|
| Thermal resistance, junction-to-case    | $R_{\theta JC}$ | 3.4        | 6          | $^\circ\text{C}/\text{W}$ |
| Thermal resistance, junction-to-ambient | $R_{\theta JA}$ | 62         | 80         | $^\circ\text{C}/\text{W}$ |

**Electrical Characteristics**  $T_c = 25^\circ\text{C}$ , unless otherwise noted

| Parameter                            | Symbol        | Test Condition  | Min. | Typ. | Max. | Unit             |
|--------------------------------------|---------------|---|------|------|------|------------------|
| <b>Static characteristics</b>        |               |   |      |      |      |                  |
| Drain-source breakdown voltage       | $BV_{DSS}$    | $V_{GS}=0\text{ V}, I_D=1\text{ mA}$  | 250  | -    | -    | V                |
| Gate threshold voltage               | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=0.25\text{mA}$  | 2.5  | 3.5  | 4.5  | V                |
| Drain cut-off current                | $I_{DSS}$     | $V_{DS}=250\text{ V}, V_{GS}=0\text{V},$<br>$T_j = 25^\circ\text{C}$<br>$T_j = 125^\circ\text{C}$ | -    | -    | 1    | $\mu\text{A}$    |
| Gate leakage current, forward        | $I_{GSSF}$    | $V_{GS}=20\text{V}, V_{DS}=0\text{V}$   | -    | -    | 500  | nA               |
| Drain-source on-state resistance     | $R_{DS(on)}$  | $V_{GS}=10\text{ V}, I_D=4\text{A}$<br>$T_j = 25^\circ\text{C}$                                   | -    | 140  | 170  | $\text{m}\Omega$ |
| <b>Dynamic characteristics</b>       |               |   |      |      |      |                  |
| Input capacitance                    | $C_{iss}$     | $V_{DS}= 100\text{V}, V_{GS}= 0\text{V},$   | -    | 371  | -    | pF               |
| Output capacitance                   | $C_{oss}$     | $f = 1\text{ MHz}$  | -    | 12   | -    |                  |
| Reverse transfer capacitance         | $C_{rss}$     |   | -    | 1.3  | -    |                  |
| Turn-on delay time                   | $t_{d(on)}$   | $V_{DD} = 100\text{V}, I_D = 5\text{A}$   | -    | 5    | -    | ns               |
| Rise time                            | $t_r$         | $R_G = 4.7\Omega, V_{GS}=10\text{V}$  | -    | 4    | -    |                  |
| Turn-off delay time                  | $t_{d(off)}$  |   | -    | 14   | -    |                  |
| Fall time                            | $t_f$         |   | -    | 2    | -    |                  |
| <b>Gate charge characteristics</b>   |               |   |      |      |      |                  |
| Gate to source charge                | $Q_{gs}$      | $V_{DD}=160\text{V}, I_D=5\text{A},$  | -    | 2.5  | -    | nC               |
| Gate to drain charge                 | $Q_{gd}$      | $V_{GS}=0\text{ to }10\text{V}$   | -    | 1.4  | -    |                  |
| Gate charge total                    | $Q_g$         |   | -    | 7.1  | -    |                  |
| Gate plateau voltage                 | $V_{plateau}$ |   | -    | 5.5  | -    | V                |
| <b>Reverse diode characteristics</b> |               |   |      |      |      |                  |
| Diode forward voltage                | $V_{SD}$      | $V_{GS}=0\text{ V}, I_F=4\text{A}$  | -    | -    | 1.2  | V                |
| Reverse recovery time                | $t_{rr}$      | $V_R=50\text{V}, I_F=5\text{A},$  | -    | 98   | -    | ns               |
| Reverse recovery charge              | $Q_{rr}$      | $di_F/dt=100\text{A}/\mu\text{s}$   | -    | 0.3  | -    | $\mu\text{C}$    |
| Peak reverse recovery current        | $I_{rrm}$     |   | -    | 6.5  | -    | A                |

## Notes:

- Limited by  $T_{j\text{max}}$ . Maximum duty cycle  $D=0.5$ .
- Repetitive rating: pulse width limited by maximum junction temperature.
- $I_{AS} = 1.5\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$ , starting  $T_j = 25^\circ\text{C}$ .

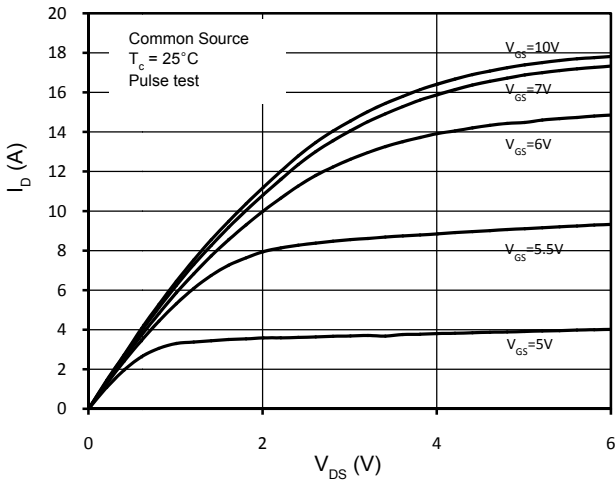


Figure 1. On-Region Characteristics

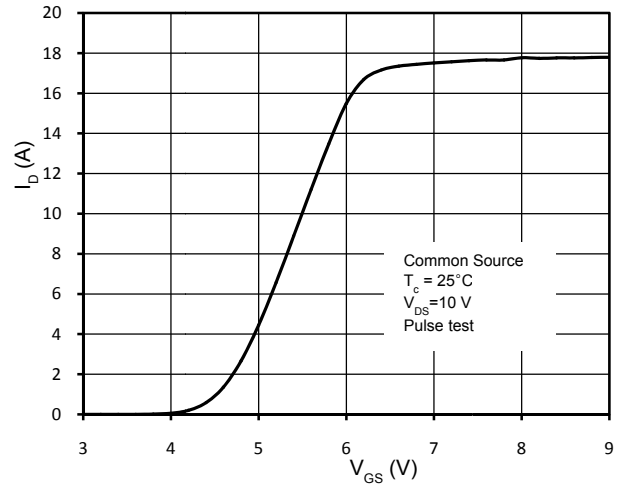


Figure 2. Transfer Characteristics

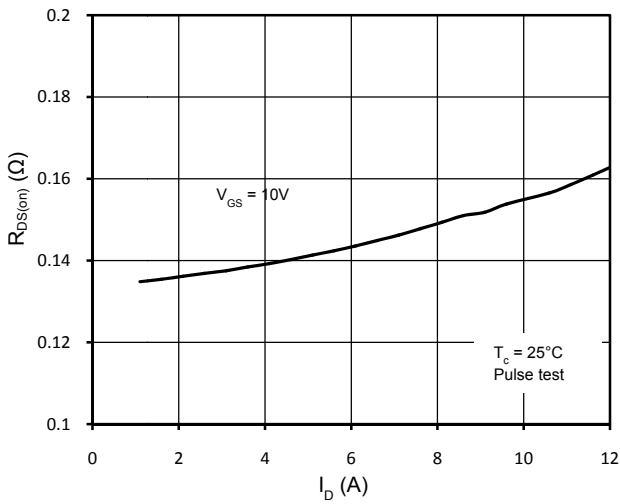


Figure 3. Static Drain-Source On Resistance

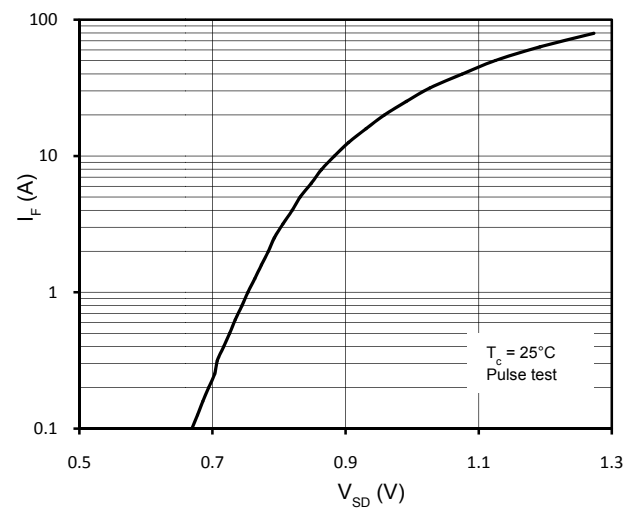


Figure 4. Body-Diode Forward Characteristics

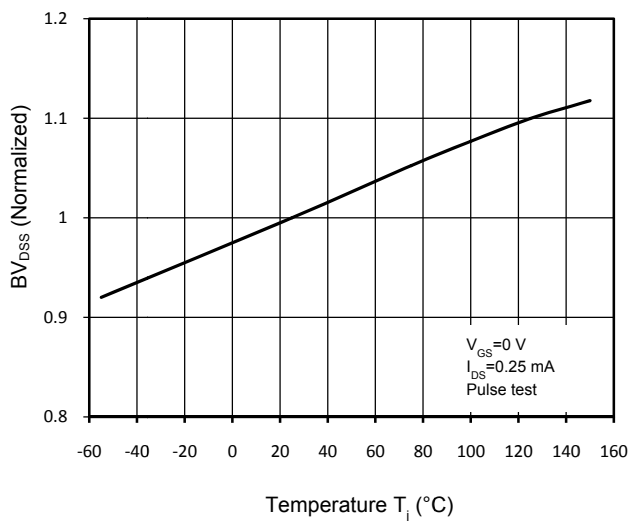


Figure 5. Normalized  $BV_{DS(s)}$  vs. Temperature

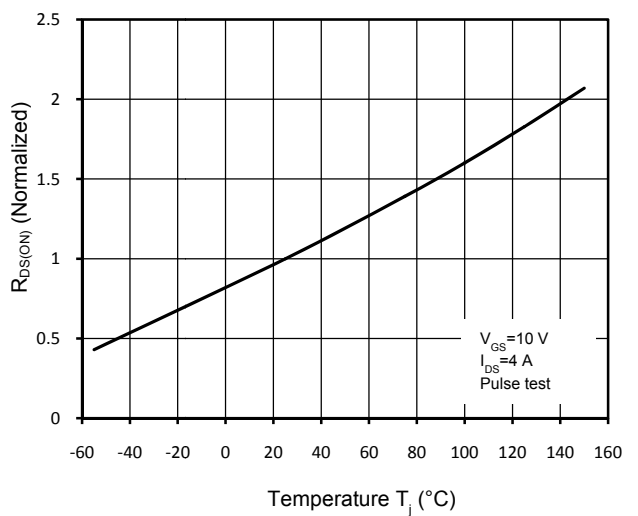


Figure 6. Normalized  $R_{DS(on)}$  vs. Temperature

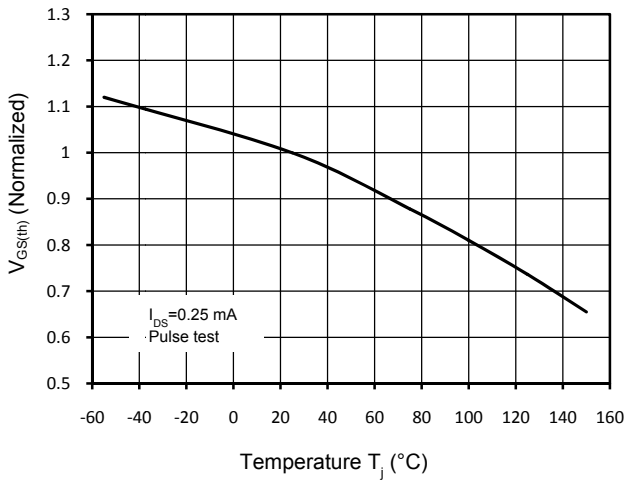


Figure 7. Threshold Voltage vs. Temperature

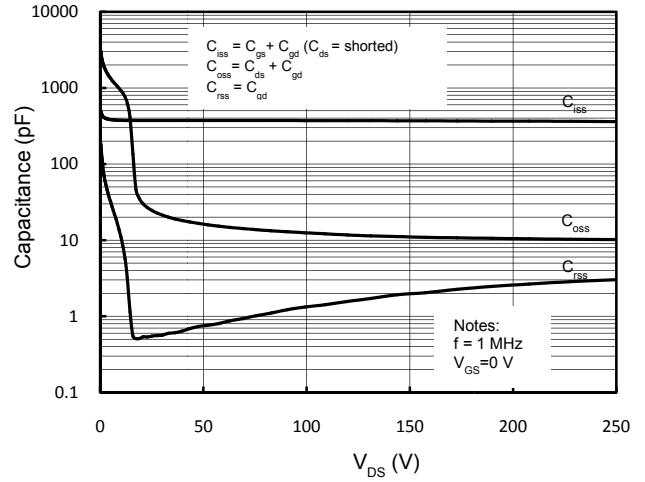


Figure 8. Capacitance Characteristics

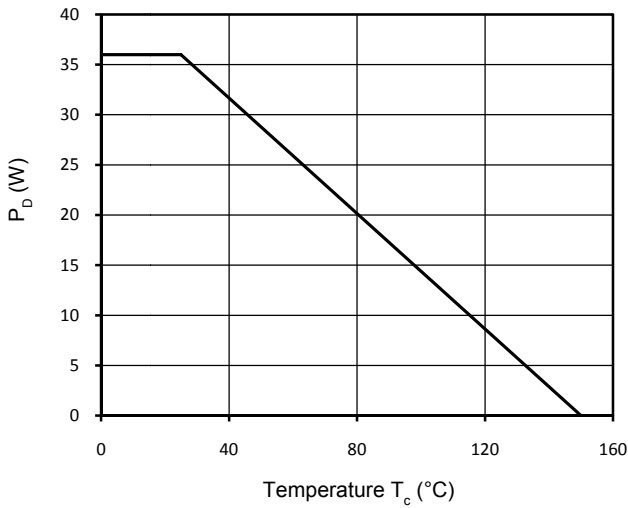


Figure 9. Power Dissipation

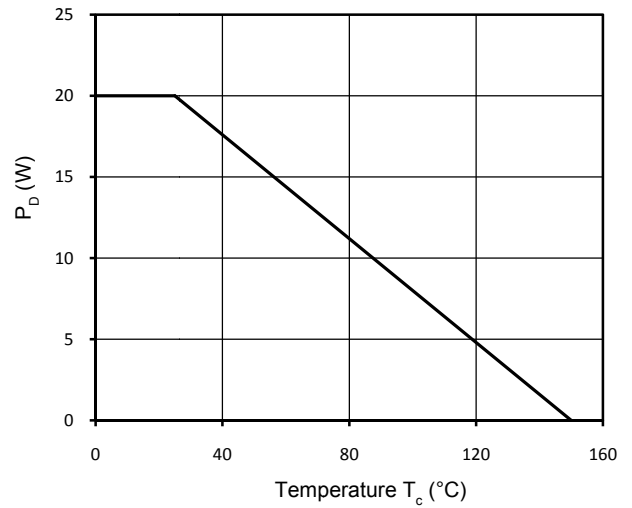


Figure 10. Power Dissipation (TO-220F)

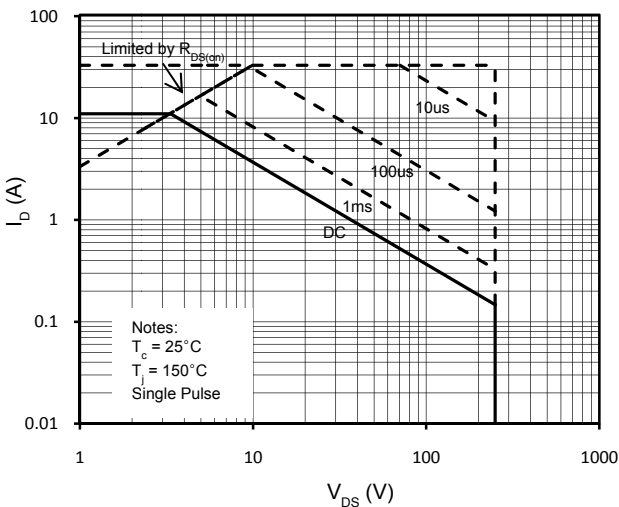


Figure 11. Maximum Safe Operating Area

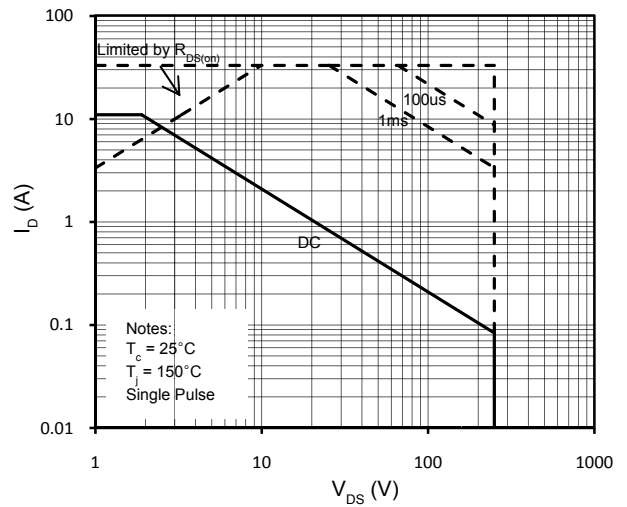


Figure 12. Maximum Safe Operating Area (TO-220F)

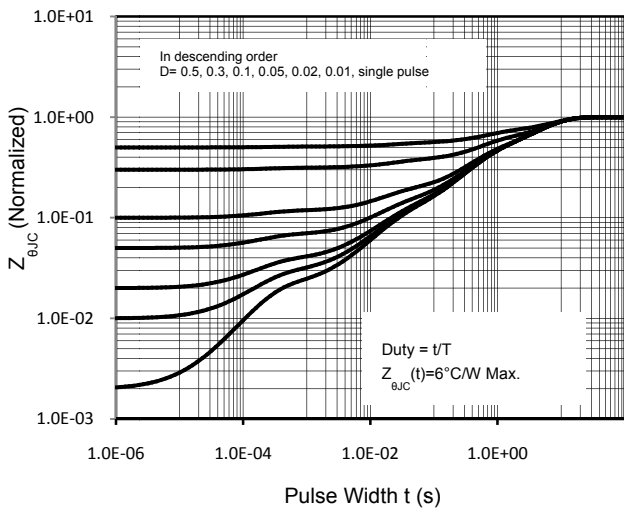


Figure 13. Transient Thermal Response Curve (TO-220F)

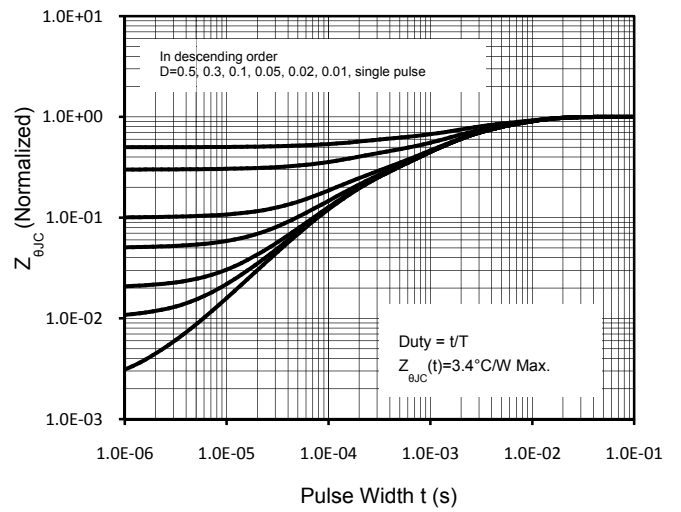


Figure 14. Transient Thermal Response Curve

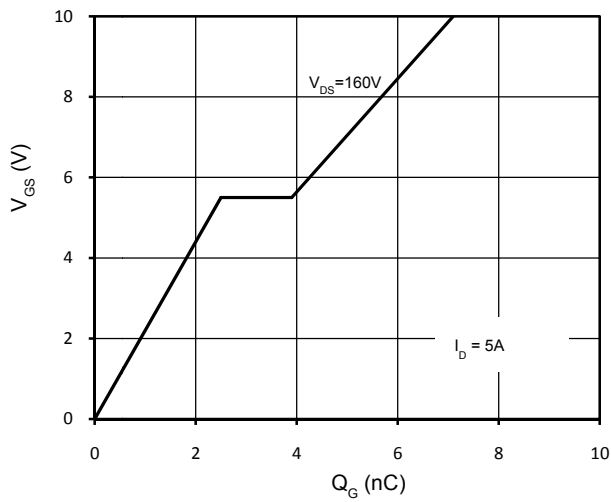
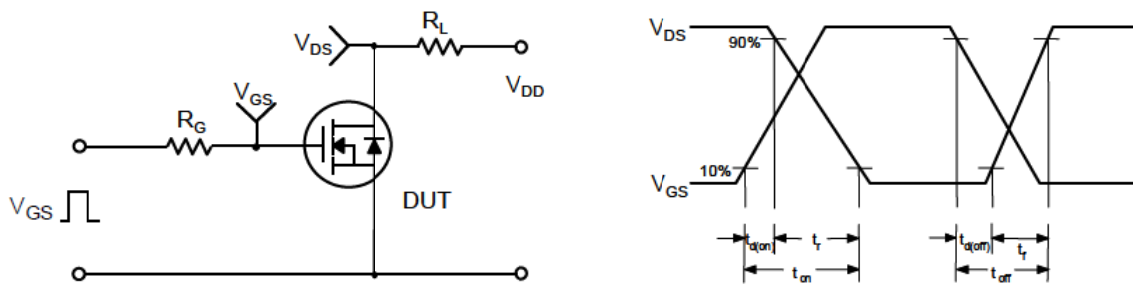


Figure 15. Gate Charge Characteristics

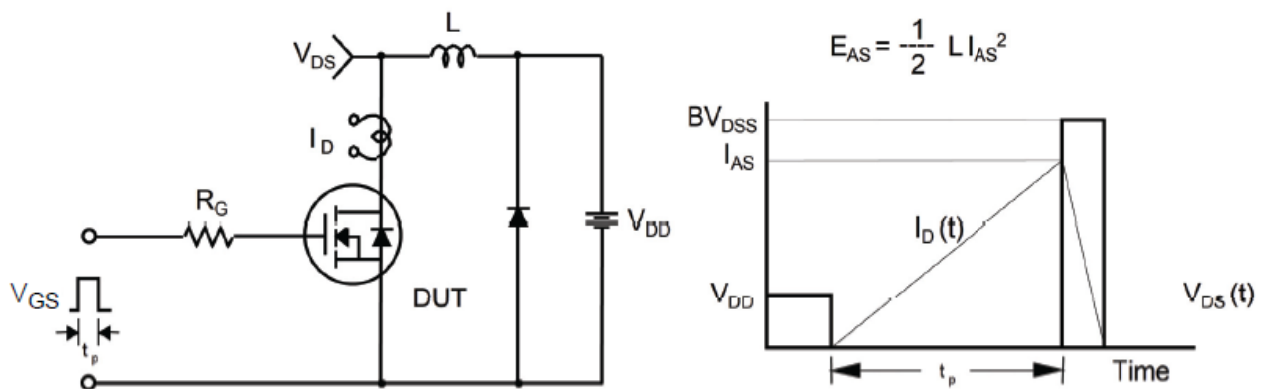
### Gate Charge Test Circuit & Waveform



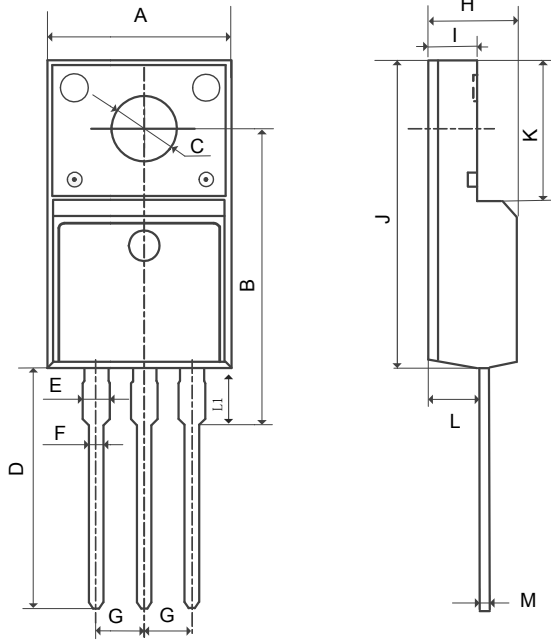
### Switching Test Circuit & Waveforms



### Unclamped Inductive Switching Test Circuit & Waveforms



## Mechanical Dimensions for TO-220F

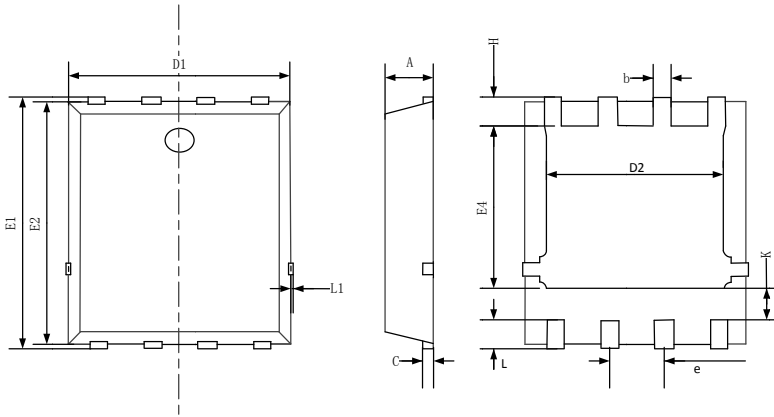


## COMMON DIMENSIONS

| SYMBOL | MM      |       |
|--------|---------|-------|
|        | MIN     | MAX   |
| A      | 9.96    | 10.36 |
| B      | 15.10   | 16.10 |
| C      | 3.03    | 3.38  |
| D      | 12.64   | 13.28 |
| E      | 1.18    | 1.58  |
| F      | 0.70    | 0.95  |
| G      | 2.54REF |       |
| H      | 4.50    | 4.90  |
| I      | 2.34    | 2.74  |
| J      | 15.57   | 16.17 |
| K      | 6.70REF |       |
| L      | 2.56    | 2.96  |
| M      | 0.40    | 0.65  |
| L1     | 2.85    | 3.45  |

Mechanical Dimensions for PDFN 5x6

COMMON DIMENSIONS

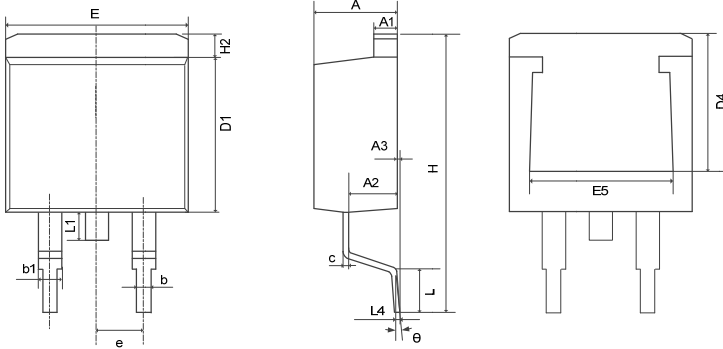


| SYMBOL | MM   |      |
|--------|------|------|
|        | MIN  | MAX  |
| A      | 1.0  | 1.2  |
| b      | 0.3  | 0.5  |
| C      | 0.15 | 0.35 |
| D1     | 5.0  | 5.4  |
| D2     | 3.8  | 4.3  |
| E1     | 5.95 | 6.35 |
| E2     | 5.66 | 6.06 |
| E4     | 3.52 | 3.92 |
| e      | 1.17 | 1.37 |
| H      | 0.4  | 0.6  |
| K      | 1.15 | 1.6  |
| L      | 0.3  | 0.7  |
| L1     |      | 0.12 |



## Mechanical Dimensions for TO-263

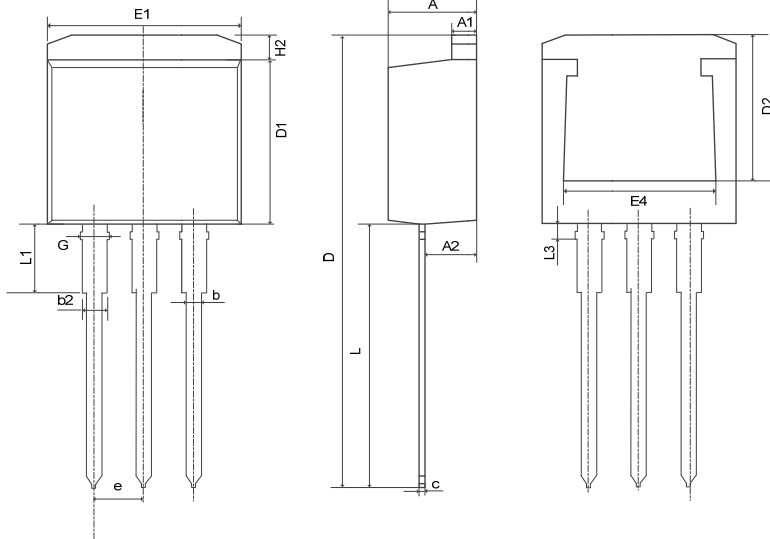
## COMMON DIMENSIONS



| SYMBOL | MM      |       |
|--------|---------|-------|
|        | MIN     | MAX   |
| A      | 4.37    | 4.89  |
| A1     | 1.17    | 1.42  |
| A2     | 2.19    | 2.89  |
| b      | 0.70    | 0.96  |
| b1     | 1.17    | 1.47  |
| c      | 0.30    | 0.60  |
| D1     | 8.45    | 9.35  |
| D4     | 6.60    | —     |
| E      | 9.80    | 10.40 |
| E5     | 7.06    | —     |
| e      | 2.54BSC |       |
| H      | 14.70   | 16.00 |
| H2     | 1.07    | 1.47  |
| L      | 2.00    | 2.70  |
| L1     | 1.15    | 1.75  |
| L4     | 0.25BSC |       |
| θ      | 0°      | 9°    |

## Mechanical Dimensions for TO-262

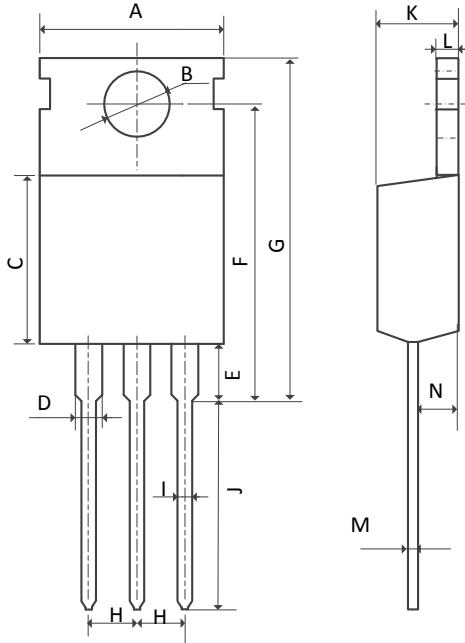
## COMMON DIMENSIONS



| SYMBOL | MM      |       |
|--------|---------|-------|
|        | MIN     | MAX   |
| A      | 4.37    | 4.90  |
| A1     | 1.17    | 1.42  |
| A2     | 2.49    | 2.89  |
| b      | 0.71    | 0.96  |
| b2     | 1.07    | 1.47  |
| c      | 0.28    | 0.53  |
| D      | 23.20   | 24.02 |
| D1     | 8.45    | 8.90  |
| D2     | 6.00    | —     |
| E1     | 9.86    | 10.40 |
| E4     | 7.06    | —     |
| e      | 2.54BSC |       |
| G      | 1.25    | 1.50  |
| H2     | —       | 1.50  |
| L      | 13.33   | 14.16 |
| L1     | 3.50    | 4.00  |
| L3     | 1.28    | 1.58  |

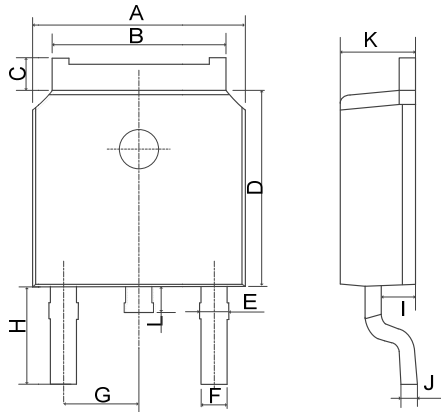
Mechanical Dimensions for TO-220

COMMON DIMENSIONS



| SYMBOL | MM       |       |
|--------|----------|-------|
|        | MIN      | MAX   |
| A      | 9.70     | 10.30 |
| B      | 3.40     | 3.80  |
| C      | 8.80     | 9.40  |
| D      | 1.17     | 1.47  |
| E      | 2.60     | 3.50  |
| F      | 15.10    | 16.90 |
| G      | 19.60MAX |       |
| H      | 2.54REF  |       |
| I      | 0.70     | 0.95  |
| J      | 9.25     | 11.00 |
| K      | 4.30     | 4.77  |
| L      | 1.20     | 1.45  |
| M      | 0.40     | 0.65  |
| N      | 2.20     | 2.60  |

## Mechanical Dimensions for TO-252

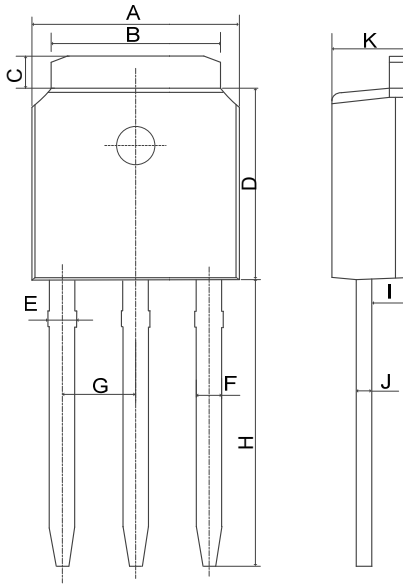


## COMMON DIMENSIONS

| SYMBOL | MM      |      |
|--------|---------|------|
|        | MIN     | MAX  |
| A      | 6.40    | 6.80 |
| B      | 5.13    | 5.50 |
| C      | 0.88    | 1.28 |
| D      | 5.90    | 6.22 |
| E      | 0.68    | 1.10 |
| F      | 0.68    | 0.91 |
| G      | 2.29REF |      |
| H      | 2.90REF |      |
| I      | 0.85    | 1.17 |
| J      | 0.51REF |      |
| K      | 2.10    | 2.50 |
| L      | 0.40    | 1.00 |

## Mechanical Dimensions for TO-251

## COMMON DIMENSIONS

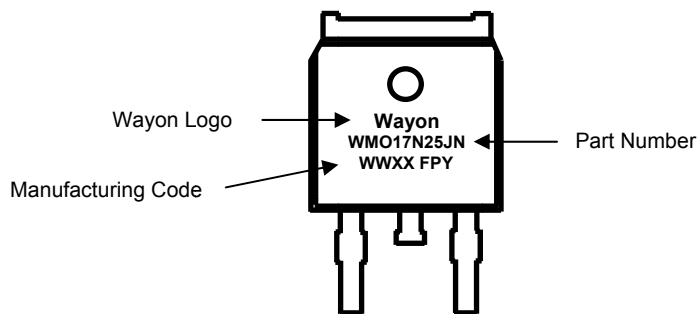


| SYMBOL | MM      |      |
|--------|---------|------|
|        | MIN     | MAX  |
| A      | 6.40    | 6.80 |
| B      | 5.13    | 5.50 |
| C      | 0.88    | 1.28 |
| D      | 5.90    | 6.22 |
| E      | 0.68    | 1.10 |
| F      | 0.68    | 0.91 |
| G      | 2.29REF |      |
| H      | 9.00    | 9.65 |
| I      | 0.85    | 1.17 |
| J      | 0.40    | 0.61 |
| K      | 2.10    | 2.50 |

## Ordering Information

| Part       | Package  | Marking    | Packing method |
|------------|----------|------------|----------------|
| WML17N25JN | TO-220F  | WML17N25JN | Tube           |
| WMK17N25JN | TO-220   | WMK17N25JN | Tube           |
| WMN17N25JN | TO-262   | WMN17N25JN | Tube           |
| WMM17N25JN | TO-263   | WMM17N25JN | Tape and Reel  |
| WMO17N25JN | TO-252   | WMO17N25JN | Tape and Reel  |
| WMB17N25JN | PDFN 5x6 | WMB17N25JN | Tape and Reel  |
| WMP17N25JN | TO-251   | WMP17N25JN | Tube           |

## Marking Information




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